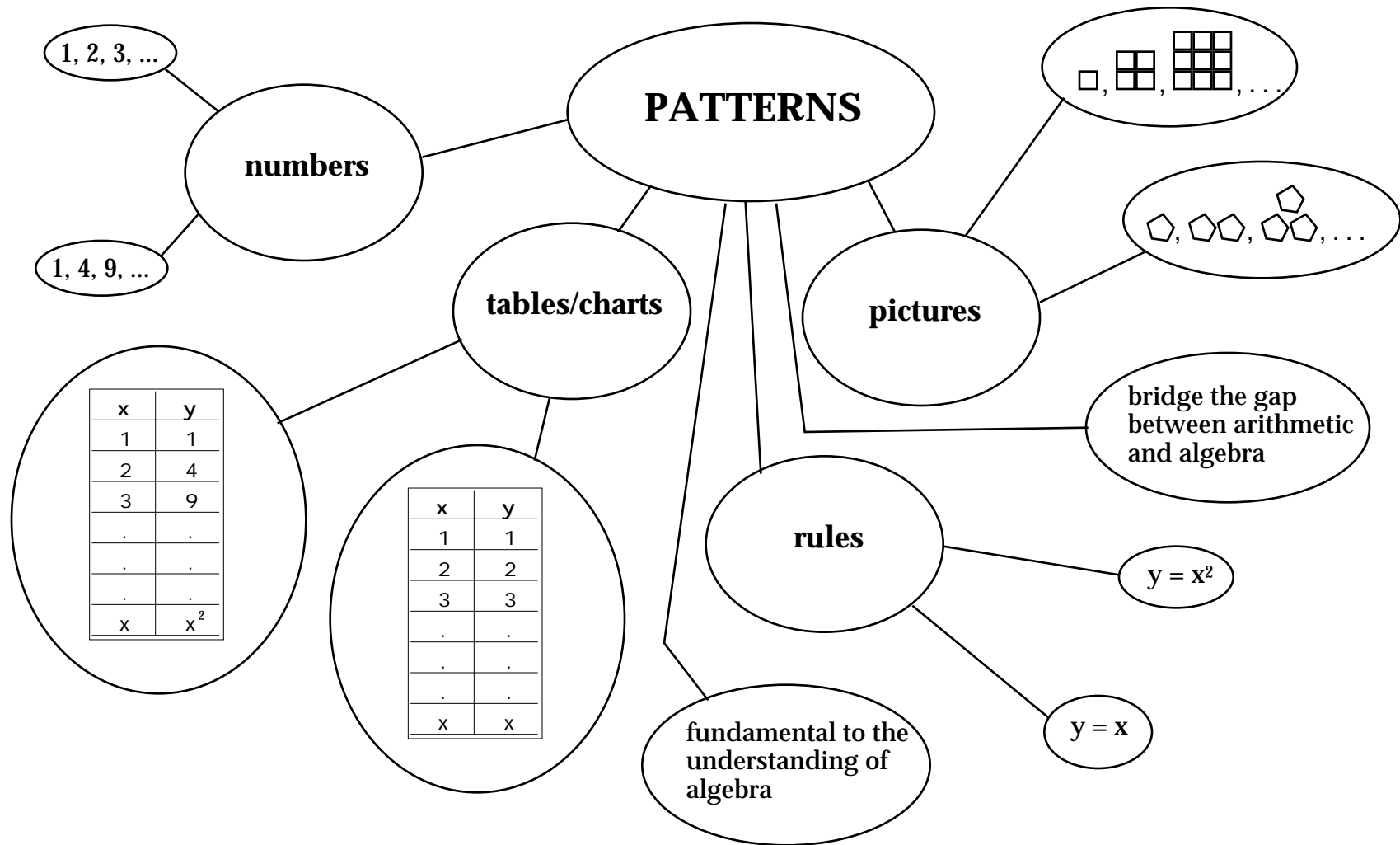# ALGEBRAIC THINKING STRAND
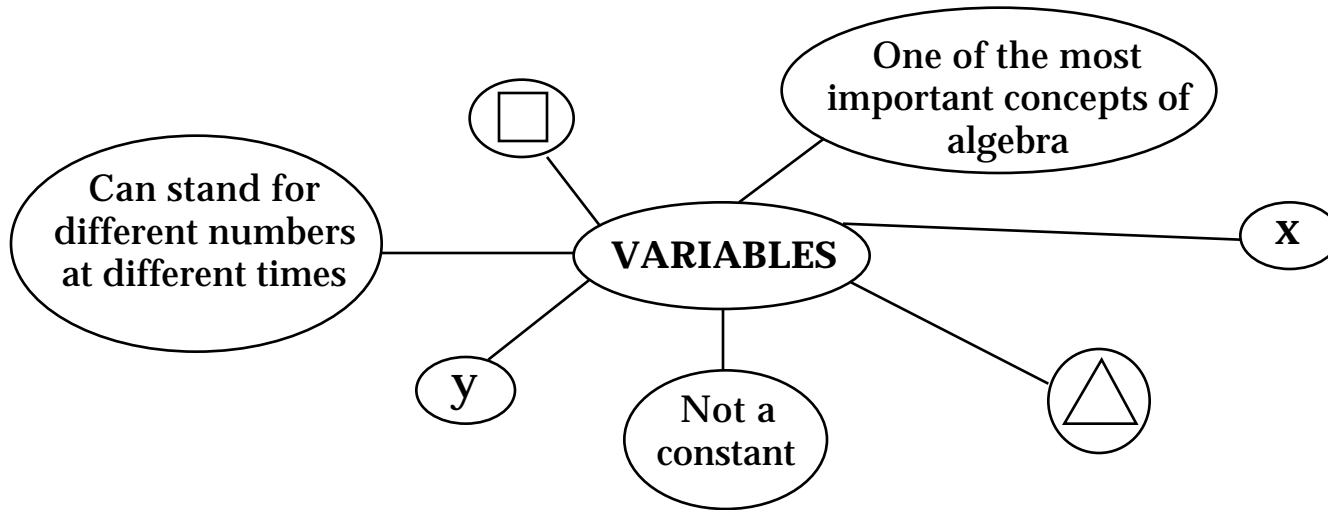
PATTERNS

Patterns allow us to generalize relationships within a set of data.

PATTERNS

1, 2, 3, ...

numbers

1, 4, 9, ...

□, ⊞, ⊞, . . .

⬠, ⬠⬠, ⬠⬠, . . .

tables/charts

pictures

x	y
1	1
2	4
3	9
.	.
.	.
.	.
x	x^2

x	y
1	1
2	2
3	3
.	.
.	.
.	.
x	x

bridge the gap between arithmetic and algebra

rules

$y = x^2$

$y = x$

fundamental to the understanding of algebra

VARIABLES and EXPRESSIONS

A **variable** is a symbol used to represent a value.

One of the most important concepts of algebra

□

Can stand for different numbers at different times

VARIABLES

x

y

Not a constant

△

An **expression** is a mathematical phrase that uses numbers, variables, and/or operations.

5

mx + b

2x + 3

EXPRESSIONS

r^2

7 - 2

$\dfrac{n}{2}$
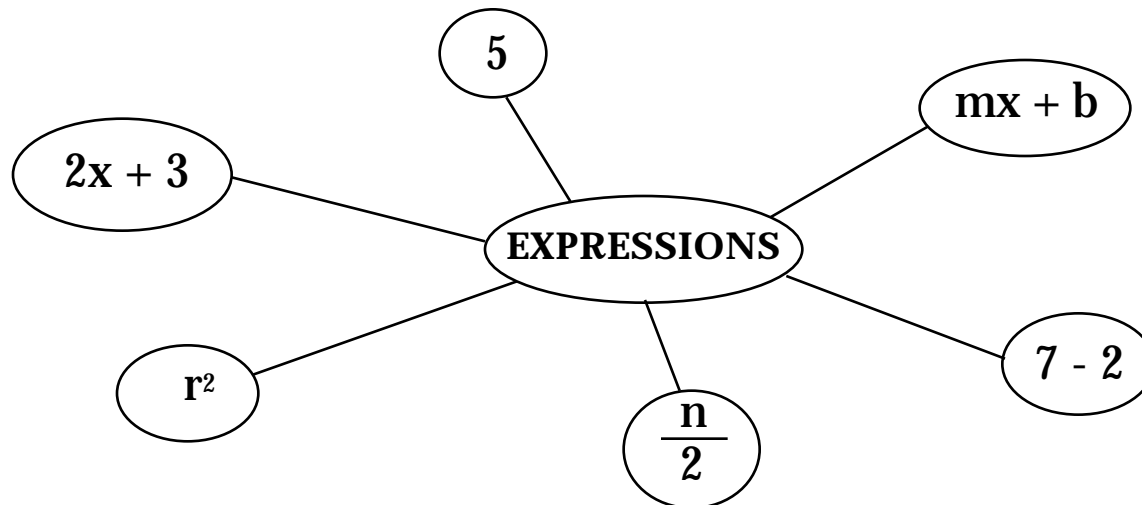
EQUATIONS and INEQUALITIES

An <u>equation</u> is a sentence that has two equal mathematical expressions.

EQUATIONS

- $2x + 3 = 15$
- $y = mx + b$
- $7 - 2 = 5$
- $3x + 4y = 10$
- $\dfrac{n}{2} = -6$
- $A = \pi r^2$
- $\dfrac{1}{3} = \dfrac{x}{100}$

Systems of Equations

- two or more related linear equations
- solving systems
  - number of solutions
    - 0; parallel lines
    - 1; intersecting lines
    - many; collinear lines
  - methods
    - linear combination (multiplication-addition)
    - graphing
    - substitution
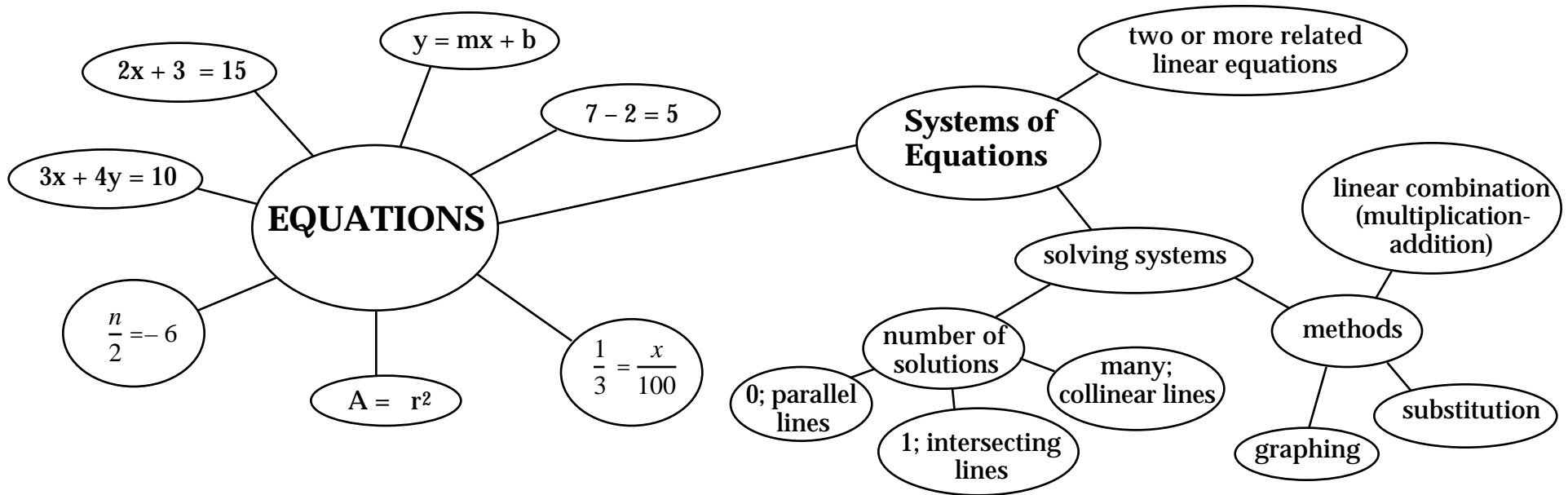
An <u>inequality</u> is any mathematical sentence that is not an equation.

INEQUALITIES

- $\dfrac{n}{2} > -6$
- $7 - 2 \ \ 3$
- $2x + 3 < 15$
- $2x + 3y \ \ 4$

Systems of Inequalities
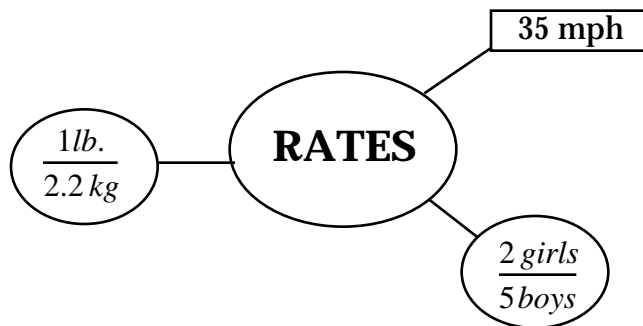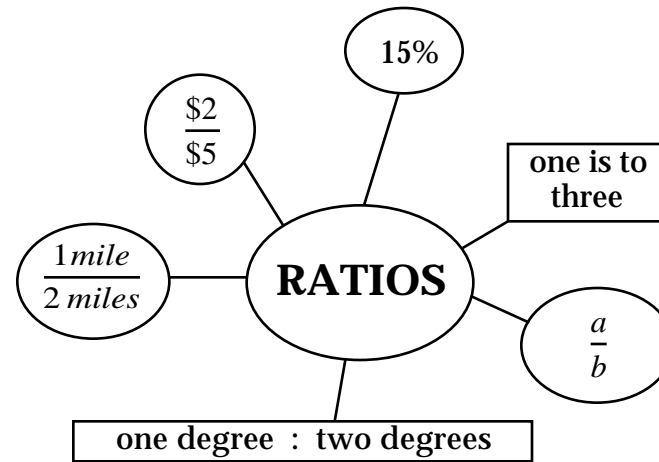
- two or more related inequalities
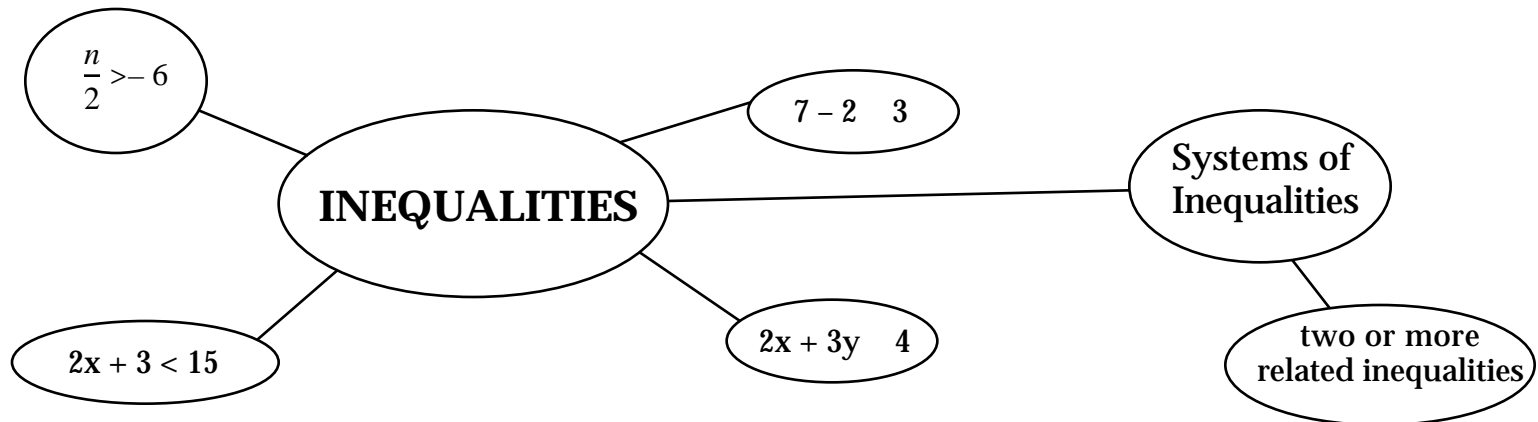
FUNCTIONS

A **function** is a relationship in which the value of one variable depends on the value of another variable; each first value may be paired with one and only one second value.

y = 3

y = | x + 2 |

x	f(x)
-1	-4
0	0
2	8

f(x) = 4x + 0

y = −3x + 3

FUNCTIONS

{ (0,1) , (-1,0) , (6,7) }

y = x + 1

x = 2

Not a function

Not a function

$x^2 + y^2 = 1$

y = -x + 4

domain(x)   range(y)

0 ⟶ 3

1 ⟶ 4

2 ⟶ 2

$y = x^2$
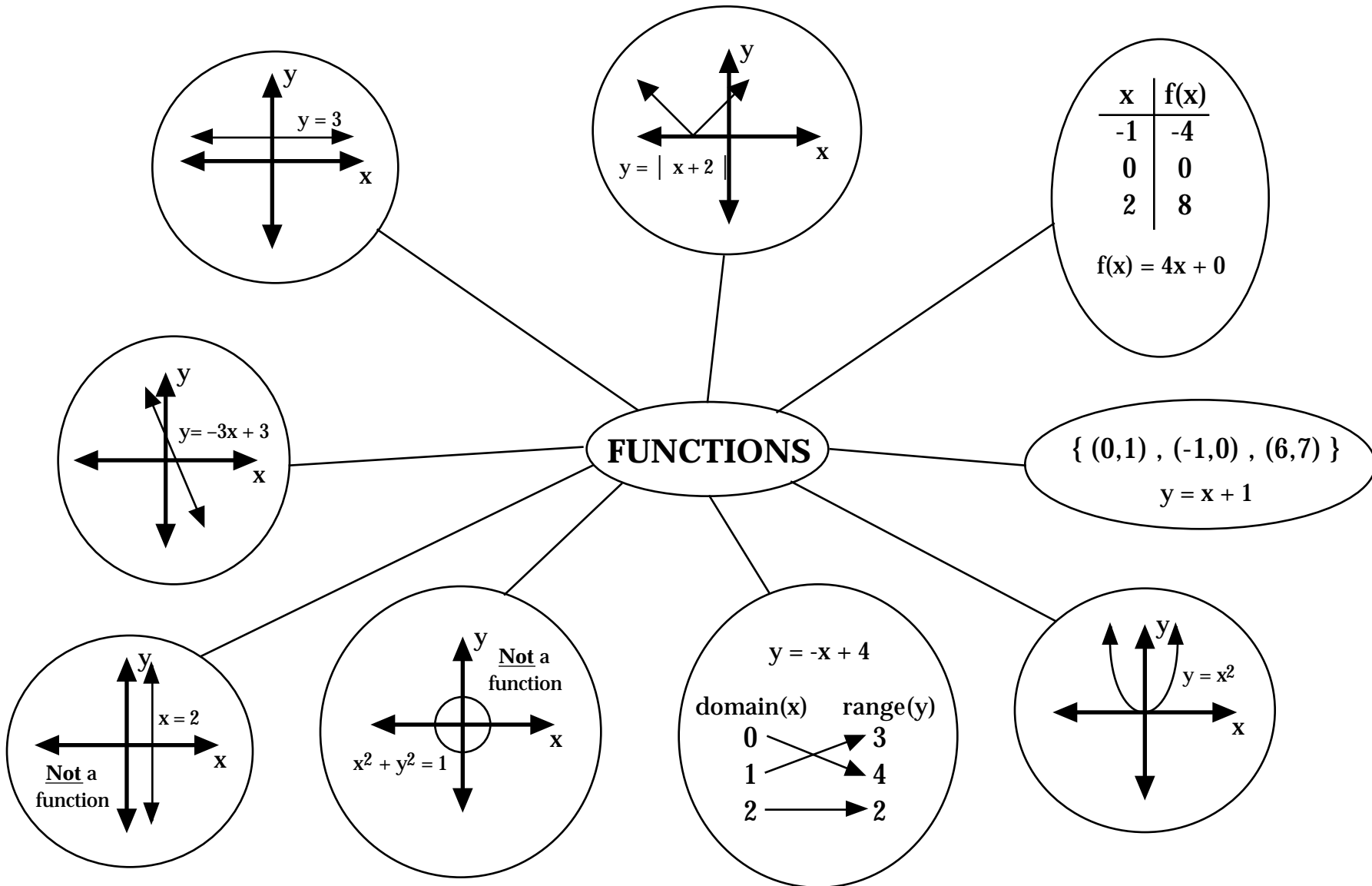
RATIOS, RATES, and PROPORTIONS

A _ratio_ is a comparison of two of the same measurements.

15%

$\dfrac{\$2}{\$5}$

one is to three

$\dfrac{1\,mile}{2\,miles}$

RATIOS

$\dfrac{a}{b}$

one degree : two degrees

35 mph

$\dfrac{1lb.}{2.2\,kg}$

RATES

$\dfrac{2\,girls}{5\,boys}$

A _rate_ is a comparison of two different measurements.

$\dfrac{a}{b} = \dfrac{c}{d}$

PROPORTIONS

$\dfrac{1lb.}{2.2\,kg} = \dfrac{10\,lb.}{22\,kg}$

A _proportion_ is a comparison of two equivalent ratios.

Not a proportion

$\dfrac{4}{20} = \dfrac{16}{100}$

$\dfrac{1}{2} = \dfrac{4}{8}$

$\dfrac{1}{3} = \dfrac{x}{100}$
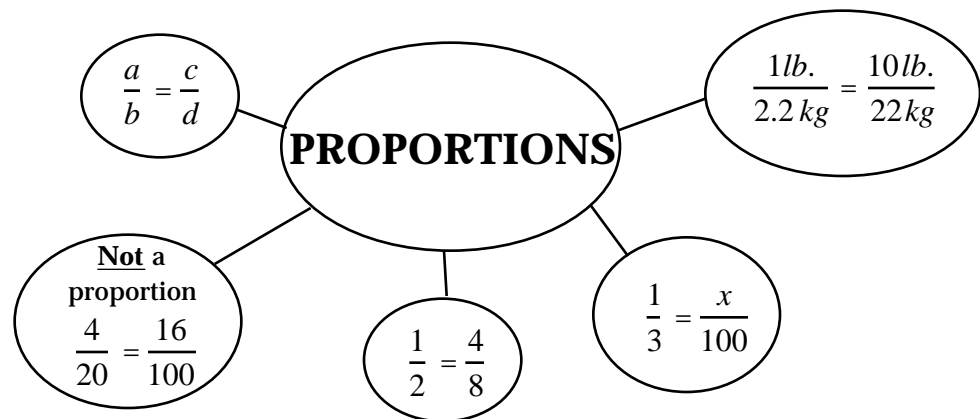
MULTIPLE REPRESENTATIONS

A single mathematical concept can be represented in a variety of forms such as symbols, words, graphs, tables, and equations . . .

x is two less than y

y = x + 2

y is two more than x

x and y have a difference of two

words

equation

MULTIPLE REPRESENTATIONS

table

x	y
-2	0
-1	1
0	2
1	3
2	4
•	•
•	•
•	•

graph
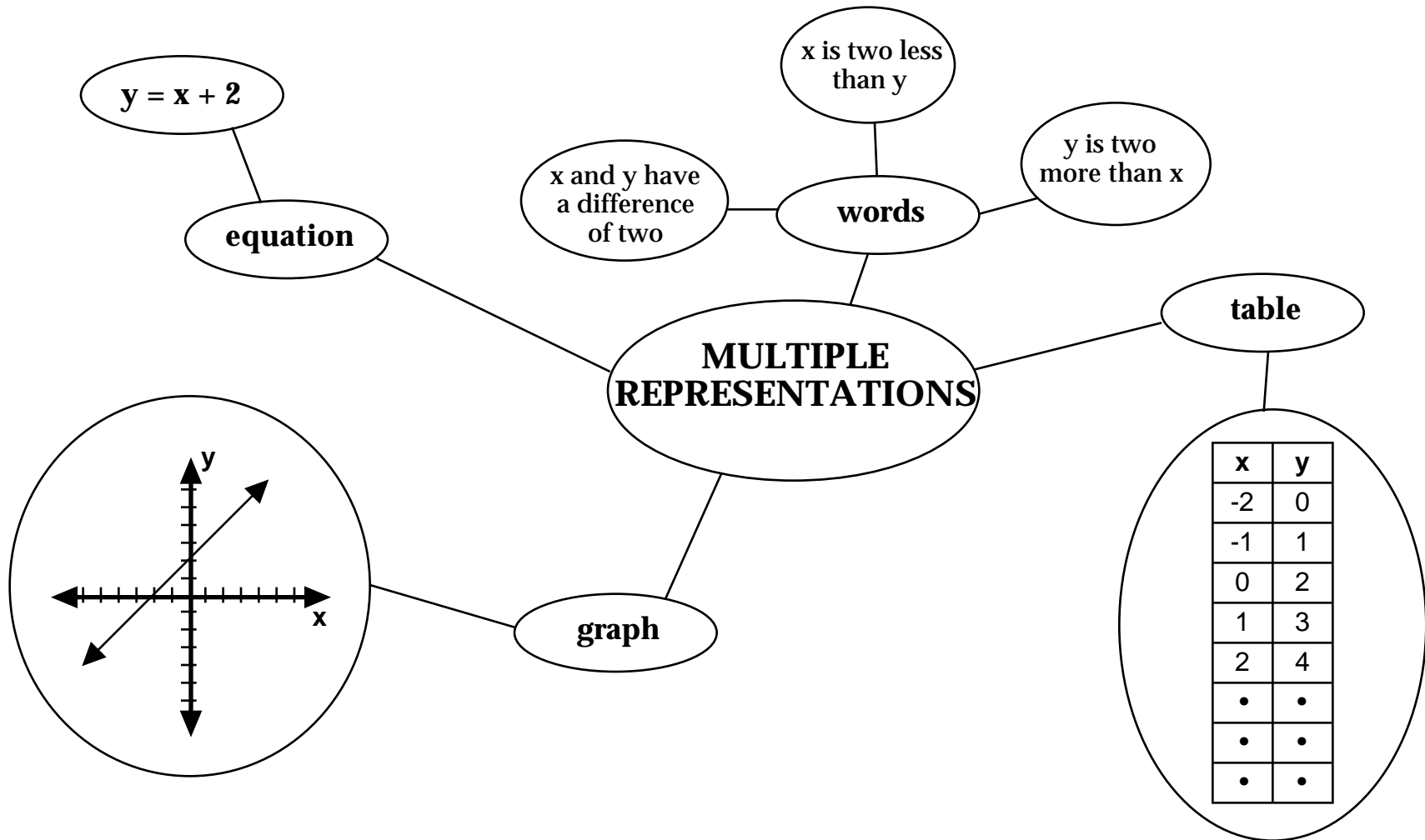
DATA ANALYSIS

The collection and organization of information into a form that is easily understood.

range

opinion polls

population count

student grades

data

measures of central tendency

mean

median

mode

Venn diagrams

DATA ANALYSIS

line

graphs

bar

circle

histogram

pictograph

interpretations

tables

normal distribution

correlations

trends

stem and leaf plots

frequency table

data table